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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/693,223	10/24/2003	Evan E. Patton	NOVLP016C1/NVLS-000403C1	2295
22434	7590	05/03/2005	EXAMINER	
BEYER WEAVER & THOMAS LLP			NGUYEN, HA T	
P.O. BOX 70250			ART UNIT	
OAKLAND, CA 94612-0250			PAPER NUMBER	
			2812	

DATE MAILED: 05/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/693,223

Applicant(s)

PATTON ET AL.

Examiner

Ha T. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 March 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 10-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 10-27 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Notice to applicant

1. Applicants' Amendment and Response to the Office Action mailed Dec. 13, 2004 has been entered and made of record.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 10-11, 19, 21, and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Dordi et al. (USPN 6267853, hereinafter "Dordi").

Referring to Fig. 3 and related text, Dordi discloses [Re claim 10] a method for electroplating a metal on a plurality of semiconductor wafers, the method comprising the steps of: processing the semiconductor wafer in a first station of a plurality of separate stations using a first sub-process chosen from a plurality of distinct sub-processes associated with metal electroplating ; and processing the semiconductor wafer in a second station of the plurality of separate stations using a second sub-process, distinct from the first sub-process, chosen from the plurality of distinct sub-processes associated with metal electroplating; wherein the plurality of distinct sub-processes associated with metal electroplating include two or more of the following : wetting, initiation, seed layer repair, fill, overburden, reclaim, electroless plating, and activation processes for electroless plating, wherein first and second stations process the semiconductor wafer in separate baths comprising distinct electrolyte compositions; and wherein, in the case where the system uses only one processing cell, all the wafers processed are processed sequentially in the first and second stations, (see Fig. 3, #228, abstract, col. 1, lines 13-21, lines

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39-48, col. 5, lines 16-49, and col. 27, line 3-col. 28, line 17). The examiner interpreted that, because of the difference in characteristics of the electroless plating (auto catalytically done) of the seed repair process and the electroplating (requiring an electric field) of the conductor, the electrolytes used in the two processes are distinct in composition.

[Re claim 11] Dordi also discloses wherein the metal is copper (see col. 18, lines 57-65);

[Re claim 19 further comprising transferring the semiconductor wafer from the first station to the second station (see col. 27, line 54- col. 28, line 17);

[Re claim 21] wherein at least two sub-processes of the plurality of distinct processes associated with metal electroplating are chemically isolated from one another (see Fig. 3, #212, 240 and related text); and

[Re claim 24] wherein the first and second stations comprise isolated electrolytic cells (see col. 27, lines 20-39).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 1038 and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 22-23 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dordi.

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[Re claims 22-23] Dordi discloses substantially the limitations of claims 22-23, as shown above.

But it fails to disclose expressly wherein wetting the semiconductor wafer is performed at an angle between about 0 and 20 degrees or between about 1 and 15 degrees deviation from the plane of the wetting solution surface.

However, Dordi discloses holding a wafer at an angle in an etching process (see col.10, lines 40-53). It would have been obvious to a person of ordinary skill in the art to wet the wafer at an angle to obtain an effective wetting ensuring that all areas are sufficiently wetted .

[Re claim 25] Dordi fails to disclose that the first and second stations are separated by a polymer or other membrane separator. However it would have been obvious for an ordinary artisan to do so since many polymeric materials are resistant to chemicals used in the electroplating process.

Therefore, it would have been obvious to use Dordi' s teaching to obtain the invention as specified in claims 22-23 and 25.

6. Claims 10, 12, 15, 20, 26, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over in view of Dordi, as applied above, in view of Rodbell et al. (USPN 6344129, hereinafter "Rodbell") .

[Re claims 10, 12, and 20] Dordi discloses substantially the limitations of claims 10, 12, and 20, as shown above. But it does not disclose expressly that the first sub-process is a fill sub-process and the second sub-process is an overburden sub-process, and that the at least two sub-processes associated with metal electroplating comprise distinct electrolyte compositions. However, the missing limitations are well known in the art because Rodbell discloses these features (See Figs. 2, 3 and col. 3, lines 37- 67) . Rodbell discloses the use of two distinct current densities, but it is not clear how many current shaping apparatus are used. However, it would have been obvious to use two current shaping apparatus to maintain consistent current densities. A person of ordinary skill is motivated to modify Dordi with Rodbell to obtain copper film of short resistance transient and good filling of high aspect ratio structures (see Rodbell, col. 2, lines 36-58).

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[Re claim 15] Rodbell also discloses a current density of at least 15 mA/cm² (see col. 3, lines 51-60). In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a *prima facie* case of obviousness exists (See MPEP 2144.05).

[Re claims 26-27] Dordi fails to disclose processing the semiconductor wafers in a third station of the plurality of separate stations using a third sub-process, distinct from the first and second sub-processes, chosen from the plurality of distinct sub-processes associated with metal electroplating, wherein the first, second and third stations process the semiconductor wafers in separate baths each comprising distinct electrolyte compositions; and wherein the plurality of distinct sub-processes associated with metal electroplating are selected from the following: wetting, initiation, overburden, reclaim, electroless plating, and activation processes for electroless plating. However, in the combined teaching of Dordi and Rodbell, when Dordi's electroplated layer is plated in a dual-step deposition process of Rodbell, a third station with different bath is used; also in this case the examiner consider the electroless plating to be the first sub-process and the deposition of the overburden layer to be the second sub-process to meet the limitations of claim 27.

Therefore, it would have been obvious to combine Dordi with Rodbell to obtain the invention as specified in claims 10, 12, 15, 20, and 26-27.

7. Claims 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dordi in view of Rodbell, as applied above, and further in view of Uzoh et al. (USPN 6355153, hereinafter “Uzoh”).

The combined teaching of Dordi and Rodbell discloses substantially the limitations of claims 16-18, as shown above.

But it does not disclose expressly the duration of the overburden sub-process. However the missing limitations are disclosed by Uzoh (see col. 9, line 9-col. 10, line 51).

A person of ordinary skill is motivated to modify Dordi and Rodbell with Uzoh to obtain an appropriate overburden layer.

Therefore, it would have been obvious to combine Dordi and Rodbell with Uzoh to obtain the invention as specified in claims 16-18.

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8. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dordi in view of Rodbell, as applied above, and further in view of Tsai et al., U.S. Patent 6224737 (Hereinafter Tsai) and Haydu et al., U.S. Patent 6024856 (Hereinafter Haydu) .

The combined teaching of Dordi and Rodbell discloses substantially the limitations of claims 13 and 14, as shown above. Rodbell also discloses in general the compositions of the electrolytes employed (see col. 3, line 5-col. 4, line 8)

But it does not disclose expressly the claimed concentrations of Cu ions, acid, suppressor and accelerator.

However, the missing limitations are well known in the art because Haydu discloses that the cu ions concentration is 15-20g/l (See col. 7, lines 15-19), acid concentration of 150-225g/l and Tsai discloses the concentrations of suppressor and accelerator of 10 to 100ppm and 1-10 ppm, respectively are conventionally used (See col. 1, line 49- col. 2, line 23) and the concentration accelerator is higher on the top portion of the copper layer .

A person of ordinary skill is motivated to modify Dordi and Rodbell with Tsai and Haydu to obtain good filling of Cu.

Therefore, it would have been obvious to combine Dordi and Rodbell with Tsai and Haydu to obtain the invention as specified in claims 13 and 14.

Response to Amendment

9. Applicants' arguments with regard to the rejections under 35 U.S.C. 102 or 103 have been fully considered, but they are not deemed to be persuasive for at least the following reasons.

Applicants' main argument is that Dordi is a parallel processing deposition system. It is true that Dordy system can perform parallel processing, however, Dordi also discloses the use of one processing cell. In the case where only one processing cell is used all the wafers are sequentially processed in the same processsing cell.

Therefor, Dordi or Dordi in combination with the applied discloses or makes obvious all the limitations of the rejected claims.

Conclusion

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10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire **THREE MONTHS** from the date of this action. In the event a first response is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than **SIX MONTHS** from the date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha T. Nguyen whose telephone number is (571) 272-1678. The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week. The telephone number for Wednesday is (703) 560-0528.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael S. Lebentritt, can be reached on (571) 272-1873. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Ha Nguyen
Primary Examiner

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